NAVAL HEALTH RESEARCH CENTER

THE ASSOCIATION BETWEEN PARTICIPATION IN HIGH SCHOOL PHYSICAL EDUCATION AND PHYSICAL FITNESS IN YOUNG MEN

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Abstract

To examine associations between high school physical education and performance on a fitness test among recent high school graduates, a questionnaire was administered to 1,633 male Marine Corps recruits (ages 17-21 years, *M* = 18.7, *SD* = 0.96) in San Diego, California, between September and November 2002. Using a logistic regression model, participation in 2 or fewer years of high school physical education was found to be associated with not passing the fitness test (odds ratio = 1.5, 95% confidence interval = 1.2–1.9) after controlling for breakfast habits, weight gain supplementation, tobacco smoking, age, race/ethnicity, and body mass index. Further study is needed to answer questions regarding optimal frequency and duration of physical activity programs for high school-aged students.

Keywords: injury, military

The Association between Participation in High School Physical Education and Physical Fitness in Young Men

Despite a resolution passed by the U.S. Congress 15 years ago to provide high quality daily physical education programs for all children in grades K-12, the physical education requirement for high school graduation across the United States has been decreasing (Haugland, Wold, & Torsheim, 2003). There is no federal law requiring physical education for students in the United States. Individual state mandates are broad, general, and open to interpretation, allowing direction for physical education to come from local school districts. In addition, as states emphasize basic skills and develop standardized tests to hold schools and students accountable for achievement in these areas, untested disciplines such as health and physical education become lower in priority.

Nationwide, only 56.1% of high school students polled in 2001 were enrolled in a physical education class (National Association for Sport and Physical Education [NASPE], 2001). In grades 11 and 12, those percentages dropped to 44.6% and 43.8%, respectively, for male students. In addition, 58% of states allow other activities such as marching band to take the place of traditional physical education, and 3 states (Colorado, Idaho, and Mississippi) do not require any physical activity at all (NASPE, 2001; see Table 1). At the same time, the problems of obesity, hypokinetic disease, and lack of physical fitness appear to be reaching epidemic proportions in the United States. Research shows that 14% of adolescents ages 12 to 19 years were overweight in 1999, up from 11% in 1988–1994 and only 5% in the late 1970s (Ogden, Flegal, Carroll, & Johnson, 2002). Besides the prevalence of overweight among the younger members of our society, other health complaints associated with stress and serious conditions

such as Type 2 diabetes are seen more than ever among children and adolescents (Rowell, Evans, Quarry-Horn, & Kerrigan, 2002).

Based on U.S. mortality rates in 2000, approximately 400,000 deaths were attributed to a combination of poor diet and physical inactivity, making these lifestyle habits second only to cigarette smoking as the leading cause of death in our country (Mokdad, Marks, Stroup, & Gerberding, 2004). Compounding this problem is the fact that only 42% of the 12,838 obese adults involved in one study had been advised by a health care professional to lose weight during the past year (McInnis, Franklin, & Rippe, 2003). In a national survey of physicians of adult patients, only 34% said that they counseled their patients about physical activity (Wee, McCarthy, Davis, & Phillips, 1999). The foregoing highlights the need for appropriate and reliable fitness and weight control education to be introduced at the high school level, to enable young adults to make good choices about their fitness and health.

The importance of physical activity for adolescents goes beyond the obvious arena of physical health into quality of life and work issues. The ability to do physical work is important for those individuals who will find jobs involving some sort of manual labor after leaving high school, or who will chose to enter the military. Achieving optimal health status is closely linked to success in all life domains. Those individuals who join the military are faced with rigorous physical fitness requirements, and their readiness to participate at the required level needs to be addressed in order to provide appropriate training and to avoid injury and loss of motivation. Various branches of the military have studied the levels of fitness within incoming recruit populations who are expected to begin a rigorous training regimen immediately after arrival at boot camp (Sharp et al., 2002). Although these groups do not represent a random sample of young men, this population still provides an excellent opportunity to test the possible association between high school physical education participation and fitness in recent high school graduates.

The present study examined this potential association by utilizing the results of a fitness test administered to incoming Marine Corps recruits during their first week at boot camp.

Methods

Protocol and Subjects

Recruits entering the Marine Corps Recruit Depot (MCRD), San Diego, California, between September and November 2002 were eligible for the study. The subjects were asked to complete a questionnaire that would subsequently be linked with administrative records that included an initial fitness assessment, measured height and weight, and geographic origin information. The questionnaire was administered to recruits within the first 3 days of arrival at MCRD (processing week), prior to the start of training. The subjects filled out the questionnaire during their routine physical exams at the MCRD Branch Medical Clinic located on base. Official Marine Corps personnel not associated with the study left the area during the administration of the survey to ensure confidentiality. The consent form was explained and any questions were answered prior to the actual administration of the questionnaire. Those agreeing to participate in the study signed an informed consent document prior to completing the questionnaire. During questionnaire administration, each item was read aloud to the recruits and study personnel circulated among the group to answer any questions. The protocol was reviewed and approved by the Institutional Review Board of the Naval Health Research Center.

Questionnaire Items

The questionnaire items consisted of basic demographic information as well as lifestyle behaviors that may be associated with incoming fitness levels. The lifestyle factors examined in this analysis included years of participation in high school physical education (dichotomized as 3 or more years/2 or fewer years), tobacco use (yes/no), average mornings per week that included breakfast (4 or more/3 or fewer), dietary habits such as the amount of soda consumed on an

average day (3 or fewer/4 or more cans per day), average number of days per week of fast food consumption (2 or fewer/3 or more), and use of weight gain or loss supplements (yes/no). Additional exposure variables not reflected on the questionnaire but available through Marine Corps administrative record data included geographic area of origin, and height (in inches) and weight (in pounds) measured during the medical clinic visit prior to training. These values were converted to kilograms and meters, respectively, and body mass index (BMI) was calculated as (kg/m^2).

Fitness Test

Prior to training, every recruit must take an entry fitness test called the Initial Strength Test (IST), which is a shorter version of the standard fitness test required for boot camp graduation. The IST consists of 3 parts (pull-ups, crunches, timed run). The maximum score of 300 points is determined as follows: the number of pull-ups (no time limit, 5 points each up to 100 points maximum), number of abdominal crunches in 2 minutes (each counts as 2 points for a maximum of 100) and time on a 1.5-mile run. (Run time is doubled and points are assigned on a sliding scale. A run time of 18:00 minutes or less is worth 100 points). On the basis of passing the IST with a score of at least 135 out of 300 points, recruits are placed in either a regular platoon or a Physical Conditioning Platoon for remedial training. The outcome used for these analyses was an IST with a score <135.

Statistical Analysis

All data were double entered and validated visually by the principal investigator. Descriptive statistics and frequencies were run for the overall study group and by initial fitness status. Differences in initial fitness status were tested for statistical significance using chi-square tests for categorical variables and *t* tests for continuous variables. In addition, analyses were done to compare study subjects with recruits who were disqualified during processing week on

demographic variables and questionnaire items. Finally, the study recruits were compared with the recruits who were dropped from the study because they were over 21 years of age.

Logistic models were developed to assess the odds of not passing the IST. Statistically significant associations were determined with 95% confidence intervals (CIs). A final logistic model was developed using variables that were individually associated with entry fitness status. Potential interactions between high school physical education and age and race/ethnicity were also examined. All analyses were performed using Epi Info™ 2000 (Centers for Disease Control and Prevention, Atlanta, Georgia), SAS Version 8 (SAS Institute, Inc., Cary, North Carolina), or SPSS Version 9 (SPSS, Inc., Chicago, Illinois) programming packages.

Results

The study population with completed surveys consisted of 2,040 male Marine Corps recruits from MCRD San Diego who entered recruit training between September and November 2002. Three recruits refused to complete a questionnaire. Of the 2,037 who completed questionnaires, 211 were dropped from subsequent fitness rosters during processing week for a variety of reasons: 10 did not take their test on time, 50 were injured during their first week at boot camp, 16 had nonspecific illnesses, 27 had pneumonia, 43 left boot camp because of "failure to adapt," 5 left for disciplinary reasons, 8 failed their urinalysis for controlled substances, 18 voluntarily left for "fitness" reasons, 6 had previously undisclosed congenital problems that disqualified them for military service, 2 died (their fitness scores from the first week of boot camp were unavailable), and 26 left boot camp for undisclosed reasons, leaving 1,826 subjects with fitness test scores as well as completed questionnaires. Compared with the complete sample, the 211 recruits without fitness data were less likely to prefer competitive

sports and more likely to have had a previous shoulder injury, but they were not different in the years of high school physical education (data not shown).

Finally, this study was limited to recruits between the ages of 17 and 21 years in order to better observe the effect of high school physical education on physical fitness in young men, resulting in a final sample size of 1,633 recruits. Compared with the study sample, recruits older than 21 years were more likely to be married, have a higher weight and BMI, less likely to prefer competitive sports, more likely to smoke tobacco and use weight loss supplements, but did not differ on fitness scores, or high school physical education participation (data not shown).

Of the 1,633 recruits represented in this study, 91% (n = 1,481) passed the IST. As shown in Table 2, only 54% of the recruits had 3 or more years of high school physical education (55% among those who passed and 44% among those who did not pass, statistically significant chi-square test at $p < 0.01$). The population was predominantly White (63%) followed by Hispanic (26%) and African American (4%). The average age of the 1,633 recruits was 18.7 $\pm$ 0.96 years (range = 17-21 years) and did not vary by test status. The mean BMI for those who passed the fitness test was 23.5 (SD = 3.19) and 26.9 (SD = 3.55) for those who did not pass the IST (statistically significant t test difference, $p < 0.01$). There was no association for age (categorized as 17-18, 19, 20-21 years) and years of high school physical education and fitness test status. Similarly, there was no difference in years of high school education by race/ethnic status.

The crude odds ratios (OR; shown in Table 3) suggest that several variables were associated with not passing the IST. Those who did not pass the IST were more likely to have participated in 2 or fewer years of high school physical education than those who passed the IST (OR = 1.4, 95% CI = 1.2–1.7). In addition, those who did not pass the fitness test were more likely than those who did to smoke tobacco (OR = 1.6, 95% CI = 1.1–2.3), skip breakfast 4 or

more mornings a week (OR = 1.8, 95% CI = 1.5–2.2), and less likely to use weight gain supplements (OR = 0.3, 95% CI = 0.2–0.6). Fitness test status was not associated with consuming 4 or more cans of soda per day or consuming fast food 3 or more day per week (Table 3).

An adjusted logistic regression model was developed that included all variables that were significant in the univariate analysis as well as age, race/ethnicity, and BMI. In this adjusted model, participating in 2 years or less of high school physical education remained a statistically significant risk factor for not passing the IST (adjusted OR = 1.5, 95% CI = 1.2–1.9) (Table 3). Smoking tobacco and skipping breakfast 4 or more days per week remained risk factors for not passing the IST in the adjusted model. The inverse relationship with use of weight gain supplements remained in the adjusted model.

Discussion

Inability to pass basic military physical fitness tests because of low fitness levels affects the readiness of the U.S. Armed Forces. Furthermore, low fitness levels may increase the risk of injury, the major cause of attrition in military populations (Shaffer, Brodine, Almeida, Williams, & Ronaghy, 1999). It has been postulated that excessive forces are transmitted to bone when the surrounding muscles are fatigued (Boden, Osbahr, & Jimenez, 2001), a distinct risk factor in young recruits who have been sedentary, but mistakenly presume that they can handle the Marine Corps training regimen. In one study, improved bone density was evident only in subjects who had participated in sports regularly for 2 years prior to training (Milgrom, Simkin, Eldad, Nyska, & Finestone, 2000), highlighting the benefits of high school physical education participation through grade 12. The current study was limited to recruits ages 21 years or younger in order to observe the effect of recent high school physical education classes. Within this population, slightly more than half (56%) reported 3 or more years of physical education

classes in high school. An increased risk of not passing the IST was associated with participating in 2 or fewer years of high school physical education.

Among the lifestyle variables that were examined in this analysis as potential modifiers of fitness were tobacco use, eating breakfast regularly, soda and fast food consumption, and use of weight gain/loss supplements. In the current study, tobacco use (smoking) was associated with not passing the IST in both the univariate and multivariate models. Although tobacco use has historically demonstrated a negative association with fitness outcomes, research within the military population has not always shown this relationship (Shaffer et al., 1999). This discrepancy could be due to the limit on tobacco use among recruit populations. The current study was conducted within a few days of arrival at boot camp, before the Marine Corps training regimen had an opportunity to affect their health or lifestyle habits.

The association between better fitness performance and breakfast consumption is in agreement with previous research on breakfast consumption and fitness (Aarnio, Winter, Kujala, & Kaprio, 2002). This association with eating breakfast persists even after controlling for age, BMI, years of high school physical education, and tobacco and supplement use.

The consumption of a fast food diet and excessive amounts of soft drinks or sodas was expected to confer additional risk of not passing the IFT. We did not find any relationship for either fast food (on 3 or more days per week) or soda (4 or more cans per day) and entry fitness. Previous research highlighted young male athletes' preference for a fast food diet (Jonnalagadda, Rosenbloom, & Skinner, 2001), but among our sample, only about one-third reported eating fast food 3 or more days per week.

Similarly, use of weight gain supplements has been associated with better fitness performance in previous studies (Shaffer et al., 1999). In the current study, individuals who used weight gain supplements were more likely to pass the fitness test, which may indicate that these

recruits had done other behaviors to improve their fitness in addition to using supplements. We did not have additional information on the type and timing of supplement use. Weight loss supplements did not demonstrate the same association.

Although the military population provides an excellent opportunity to observe the effect of participation in high school physical education on fitness performance, there are limitations as well. Some of these limitations include the inability to generalize findings to the population at large as well as issues of confidentiality. Despite knowledge of an approved privacy procedure, the recruits may have been reticent to disclose all previous behaviors for fear of consequences that would affect their training program. Use of individuals who volunteer to serve in the military raises the problem of selection bias, since those who are overweight or very unfit or have chronic conditions are not included in the sample. Other limitations include the scope of the information collected on high school sports and physical education participation. In addition to years of physical education participation, future studies should include more detail on type of activities, specific sports played, and extracurricular sports participation.

In conclusion, the present study demonstrates that more than 2 years of high school physical education participation is associated with passing a standardized test of physical fitness administered to young men entering the military shortly after high school. Increased participation in high school physical education may also improve physical ability to do other jobs after high school, as well as contribute to an overall better quality of life.

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Table 1

High School Physical Education Requirements in the 50 United States and the District of Columbia, NASPE, 2001 Shape of the Nation Report

State	Requirement (years)	Substitution. Yes/No[a]	State	Requirement (years)	Substitution Yes/No [a]
Alabama	1	No	Montana	1	No
Alaska	1	Yes	Nebraska	Varies by district	Yes
Arizona	Varies by district	NA	Nevada	2	Yes
Arkansas	0.5	No	New Hampshire	1	Yes
California	2	Yes	New Jersey	3	Yes
Colorado	0		New Mexico	1	Yes
Connecticut	1	No	New York	2	Yes
Delaware	1	Yes	North Carolina	0.5	No
District of Columbia	2	No	North Dakota	1	No
Florida	1	Yes	Ohio	0.5	NA
Georgia	0.5	No	Oklahoma	Varies by district	Yes
Hawaii	1	No	Oregon	1	Yes
Idaho	0		Pennsylvania	Varies by district	No
Illinois	4	Yes	Rhode Island	Varies by district	No
Indiana	1	No	South Carolina	1	Yes
Iowa	4	Yes	South Dakota	Varies by district	NA
Kansas	1	No	Tennessee	Varies by district	No
Kentucky	0.5	No	Texas	1.5	Yes
Louisiana	1.5	Yes	Utah	1.5	No
Maine	1	No	Vermont	1.5	Yes
Maryland	0.5	No	Virginia	2	Yes
Massachusetts	Varies by district	Yes	Washington	2	Yes
Michigan	Varies by district	Yes	West Virginia	1	No
Minnesota	Varies by district	Yes	Wisconsin	1.5	No
Mississippi	0		Wyoming	Varies by district	Yes
Missouri	1	No			

Note. NASPE = National Association for Sport and Physical Education. NA = No information available.
[a]Substitutions allowed for activities such as marching band, health education classes, and recreational sports.

Table 2

Distribution of Demographic Variables and Participation in High School Physical Education by Fitness Test Status for 1,633 Male Marine Corps Recruits, San Diego, California, 2002

Characteristic	Overall (*N* = 1,633)	Passed (*N* = 1,481)	Did not pass (*N* = 152)	*P**
		%(*n*)		
High school physical education				<0.01
3 years or more	53.6 (875)	54.6 (808)	44.1 (67)	
3 years or less	46.4 (758)	45.4 (673)	55.9 (85)	
Race/Ethnicity:				0.22
White	62.8 (1,025)	62.9 (931)	61.8 (94)	
Hispanic	25.9 (423)	25.6 (379)	28.9 (44)	
African American	4.3 (71)	4.7 (69)	1.3 (2)	
Other or declined to state	6.9(114)	6.9 (102)	7.9 (12)	
		*M*s (*SD*) (range)		
Age (years)	18.7 (0.96) (17-21)	18.7 (0.97) (17-21)	18.8 (0.91) (17-21)	0.37
Body mass index (kg/m^2)	23.8 (3.37) (14.0-36.6)	23.5 (3.19) (14.6-31.2)	26.9 (3.55) (14.0-36.6)	<0.01

*Chi-square test for categorical variables, *t* test for continuous variables.

Table 3

Crude and Adjusted Odds Ratios of Not Passing an Entry Fitness Test Among 1,633 Male Marine Corps Recruits Ages 17 and 21 years, San Diego, California, 2002

Variable	Recruits %(*n*)	Crude OR (95% CI)	Adjusted OR[a] (95% CI)
High school physical education			
3 years or more	53.6 (875)	1.00	1.00
2 years or less	46.4 (758)	1.4 (1.2, 1.7)	1.5 (1.2, 1.9)
Ever smoked tobacco			
No	82.2 (1,342)	1.00	1.00
Yes	17.8 (291)	1.6 (1.1, 2.3)	1.6 (1.0, 2.5)
Breakfast consumed in last 2 months			
4 or more mornings per week	51.2 (836)	1.00	1.00
3 or fewer mornings per week	48.8 (797)	1.8 (1.5, 2.2)	1.7 (1.4, 2.1)
Soda consumed in last 2 months			
3 or fewer cans per day	80.6 (1,316)	1.00	--
4 or more cans per day	19.4 (317)	1.1 (0.8, 1.4)	--
Fast food consumed in last 2 months			
2 or less days a week	64.6 (1,055)	1.00	--
3 or more days a week	35.4 (578)	0.8 (0.5, 1.1)	--
Ever used weight gain supplements			
No	83.4 (1,362)	1.00	1.00
Yes	16.6 (271)	0.3 (0.2, 0.6)	0.4 (0.2, 0.9)
Ever used weight loss supplements			
No	92.6 (1,512)	1.00	--
Yes	7.4 (121)	1.2 (0.9, 1.5)	--

Note. OR = odds ratio. CI = confidence interval.
[a]Adjusted for all variables shown, plus age, race/ethnicity, and body mass index. -2 Log likelihood chi-square: 158.13, (9 *df*) $p < 0.001$.

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14. ABSTRACT (maximum 200 words)

The purpose of this study was to examine the association between participation in high school physical education and performance on a fitness test among recent high school graduates. A questionnaire was administered to 1,633 male Marine Corps recruits (ages 17-21 years, *M* = 18.7, *SD* = 0.96) in San Diego, California, between September and November 2002. Items included a variety of behaviors including years of participation in high school physical education classes. A logistic regression model assessed items associated with failing a physical fitness test prior to recruit training. Participation in 2 or fewer years of high school physical education was associated with not passing the fitness test (odds ratio = 1.5, 95% confidence interval =1.2–1.9) after controlling for breakfast habits, weight gain supplementation, tobacco smoking, age, race/ethnicity, and body mass index. Participation in high school physical education appears to be independently associated with physical fitness in young men. Further study is needed to answer questions regarding optimal frequency and duration of physical activity programs for high school-aged students.

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